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STUDENT'S HAND-BOOK

OF

MUSHROOMS OF AMERICA

EDIBLE AND POISONOUS.

BY

THOMAS TAYLOR, M. D.

AUTHOR OF FOOD PRODUCTS, ETC.

Published in Serial Form—No. 3—Price, 50c. per number.

WASHINGTON, D. C. :

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PLATE E.

Plate E illustrates various forms and positions of the annulus or ring characteristic of certain species of mushrooms, together with the cortina or veil of which the ring, if present, is the remnant, in some species, either as it appears entire or as a fringe on the margin of the cap, contrasting these forms with a sectional view of a species in which the veil or ring is always wanting.

Fig. 1. Ring broad, reflexed or deflexed, or both; situated high up on the stem, as in *Armillaria mellea*.

Fig. 2. Ring situated about midway of the stem, deflexed and pendulous as in *Amanita muscaria*.

Fig. 3. Ring about half midway of the stem, split, and radiating outwards, as in *Agaricus arvensis*.

Fig. 4. Ring drooping.

Fig. 5. Ring persistent, movable, wholly detached, in age, from the tall and slender stem, upon which it easily slips up and down. A species of great beauty, *Lepiota procera*.

Fig. 6. Ring narrow, scarcely perceptible above the middle of the stem; remnants of the veil adhering to the margin of the cap as a fugacious web.

Fig. 7. Ring generally wanting—*Tricholoma nudum*. Remnants of the veil seen on the margin of the cap.

Fig. 8. Remnants of the veil appearing on the margin of the cap as a fringe, and particularly on the stem as a mere fibrillose zone of a darker color as in the *Cortinariæ*.

Fig. 9. Plant exhibiting the cortina unbroken, the extremities of its delicate arachnoid threads attached to cap and stem, respectively.

Fig. 10. Section of a *Russula*, in which genus the ring is always wanting; veil none.

PLATE F.

Plate F illustrates by section or otherwise various forms of these gill-like processes characteristic of species, considered either with regard to marginal outline or position of their posterior extremity:

Fig. 1. Gills distant.

Fig. 2. Gills crowded.

Fig. 3. Gills flexuose.

Fig. 4. Gills unequal.

Fig. 5. Bifurcated.

Fig. 6. Anastomosing veins.

Fig. 6a. Sectional view.

Fig. 7. Gills narrow.

Fig. 8. Gills broad.

Fig. 9. Lanceolate.

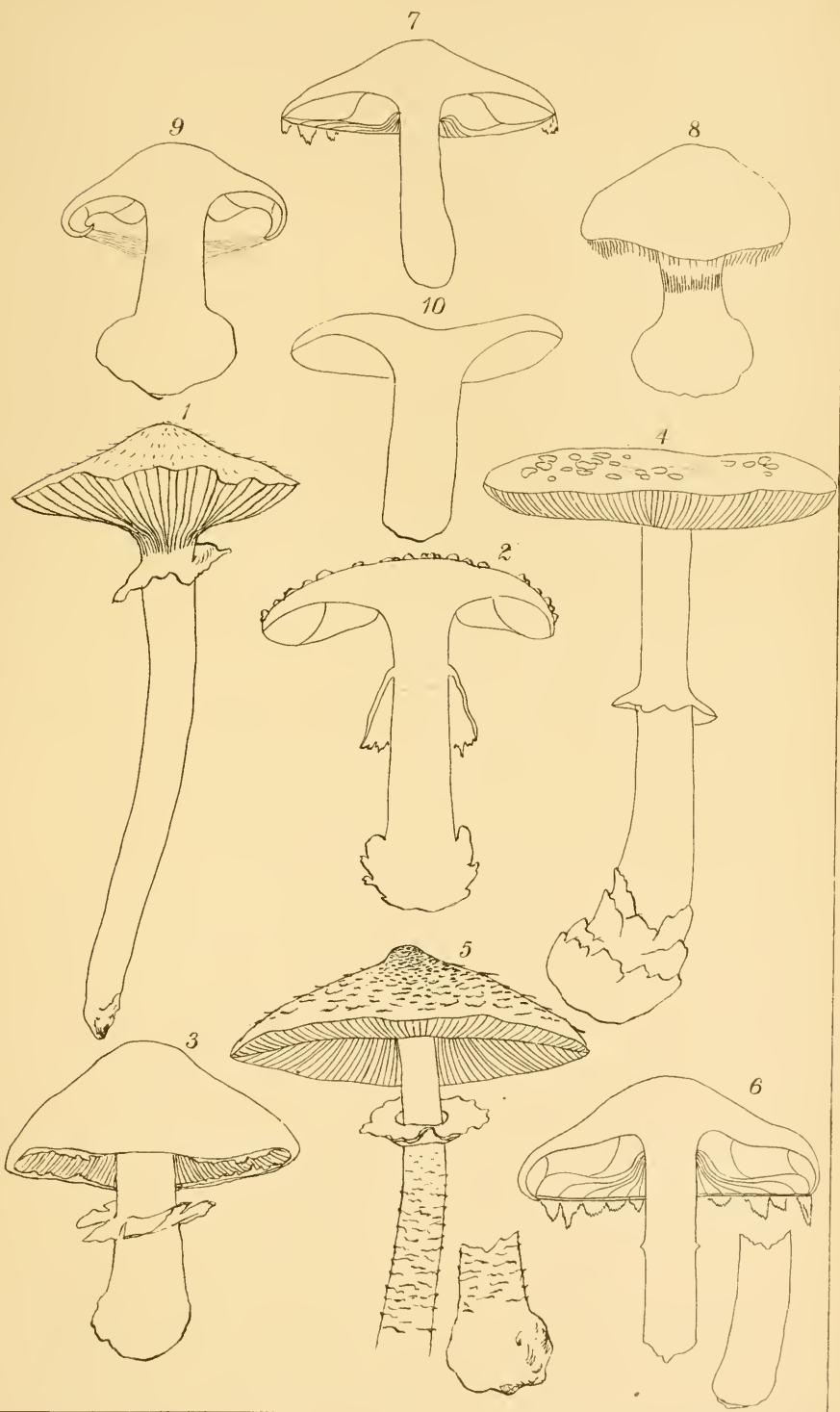
Fig. 10. Ventricose.

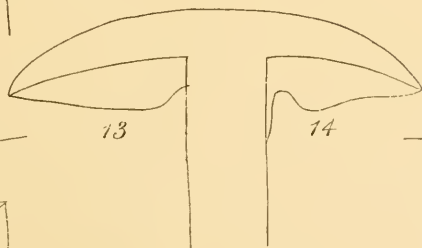
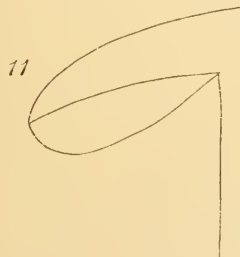
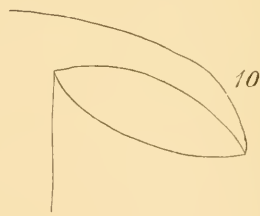
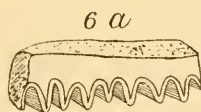
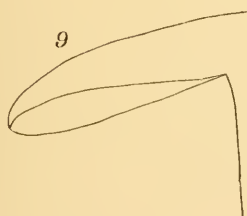
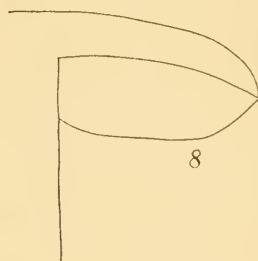
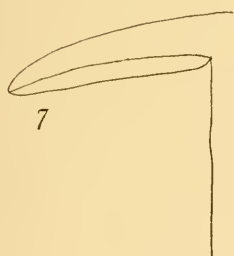
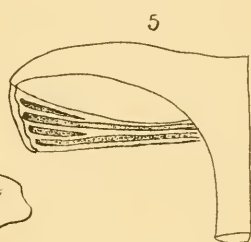
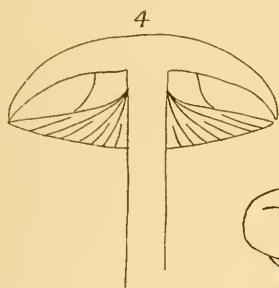
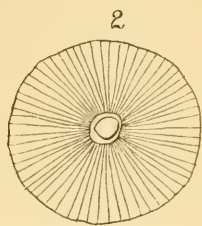
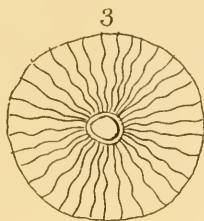
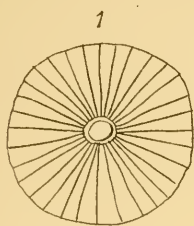
Fig. 11. Anteriorly rounded.

Fig. 12. Posteriorly rounded.

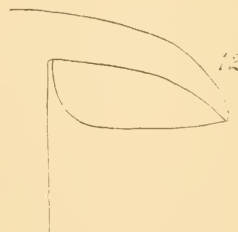
Fig. 13. Emarginate.

Fig. 14. Emarginate and denticulate.





14



AGARICINI.

Subgenus Hypholoma. Hymenophore continuous with the stem, veil woven into a fugacious web, which adheres to the margin of the pileus. Gills adnate or sinuate; spores brownish purple, sometimes intense purple, almost black.—M. C. Cooke.

This subgenus has been divided into the following five groups:

1. Fasciculares.—Pileus smooth, tough, bright colored when dry, not hygrophanous. Examples, Ag. (*Hypholoma*) *sublateritius* and Ag. (*Hypholoma*) *fascicularis*.
2. Viscidi.—Pileus naked, viscid. Example, Ag. (*Hypholoma*) *edipus*.
3. Velutini.—Pileus silky, with innate fibrils. Example, Ag. (*Hypholoma*) *velutinus*.
4. Flocculosi.—Pileus clad with floccose superficial evanescent scales. Example, Ag. (*Hypholoma*) *cascus*.
5. Appendiculati.—Pileus smooth and hygrophanous. Example, Ag. (*Hypholoma*) *Candollianus*.

The species are not numerous. They are generally either gregarious or caespitose, and are often found in clusters upon tree stumps, or springing from the buried roots of stumps. A few species are found in short grass in open places; but few are recorded as edible, and one, *H. fascicularis*, has been classed as deleterious by Berkeley, Cooke, and some of the earlier authors. I find, however, no authenticated case of poisoning by this species, and, indeed, have as yet found no species of *Hypholoma* which could be satisfactorily identified as *H. fascicularis*.

The few species of *Hypholoma* which I have tested have been palatable, and one or two are of very delicate flavor.

PLATE VIII.

Ag. (*Hypholoma*) *sublateritius* Schaeff. "*Red Tuft.*" (*Hypholoma* *sublateritium*)
"*The Brick Top.*"

EDIBLE.

The cap of this species is fleshy and obtuse, convexo-plane, sometimes showing a superficial whitish cloudiness upon the margin coming from the veil, which soon disappears, leaving it smooth and dry; color tawny brick red, with pale straw margin; flesh compact and whitish, turning yellow when wilted. Stem stuffed and fibrillose, tapering downward. Near its attachment to the cap the color is very light yellow; lower down and towards the root it is covered with patches and lines of burnt sienna color. It bears no distinct ring. In very young plants the filmy veil is sometimes perceived, reaching from the margin of the cap to the stem. This disappears as the cap expands, sometimes leaving the stem obscurely



T Taylor del.

EDIBLE

Agaricus (Hypholoma) *Campbellianus*, Fries., variety *inversus* Peck.
 Figured from specimens collected in the District of Columbia.

arising from the attachment to it of fragments of the veil, but usually it is ringless.

The typical species of *Hypholoma* have the fleshy part of the cap confluent with the stem, but in *H. incertum* the stem is not confluent and is easily separated from the cap as in the *Lepiotas*. This mushroom was first recorded by Peck in his early reports as the variety "*incertus*" of the species *Agaricus* (*Hypholoma*) *Candollianus*, but has since been recorded by Saccardo as a distinct species, *Hypholoma incertum*.

Two species of *Hypholoma* have the same habit and sufficiently resemble *incertum* to be taken for it, if not carefully examined as to points of difference. These are *H. Candollianum*, named in honor of A. De Candolle, and *H. appendiculatum*. In the first named of these two species the cap is whitish, the gills at first violet in color, changing to dark cinnamon brown. In *H. appendiculatum* the pileus is rugose when dry, and sprinkled with atoms. It is darker in color than that of *H. incertum*; Cooke says tawny or pale ochre; Massée says bay, then tawny. The gills are sub-adnate, in color resembling those of *H. incertum*; stem slender, smooth, and white.

From the foregoing it will be seen that *H. incertum* agrees more nearly with *H. Candollianum* in the color of the cap, but more nearly with *H. appendiculatum* in the color of the gills. Saccardo recognizes the three as "distinct species of the genus *Hypholoma*." As all are edible, the slight differences observed are interesting chiefly to the mycologist. The mycophagist will find them equally valuable from a gastronomic point of view. In taste they resemble the common mushroom. They are more fragile, however, and require less cooking than the cultivated mushroom. Broiled on toast or cooked for ten minutes in a chafing dish, they make a very acceptable addition to the lunch menu.

The specimens figured in Plate IX were selected from a crop of thirty or more growing in the author's garden, in very rich soil at the base of a plum-tree stump. For several seasons past small crops have been gathered from the same spot, as well as around the base of a flourishing peach tree. Quantities of all three species have been gathered in the short grass of the Capitol grounds for a number of seasons, and in the various parks of the District of Columbia. Specimens have been received from western New York and Massachusetts. Those growing upon soil very heavily fertilized are apt to be somewhat stouter and shorter stemmed than those coming up through the short grass in the parks.

ANALYTICAL TABLE.

The following compendious analytical table showing prominent characteristics of the leading genera and subgenera of the order Agaricini, according to Fries, Worthington Smith, and other botanists, which appears in Cooke's *Hand Book*, revised edition, will be found helpful to the collector in determining the genus to which a specimen may belong.

ORDER AGARICINI.

I. Spores white, or very slightly tinted.—Leucospori.

- * Plant fleshy, more or less firm, putrescent (neither deliquescent nor coriaceous).

- † Hymenophore free.

- Pileus bearing warts or patches free from the cuticle (volvate),

- Amanita*

- Pileus scaly, scales concrete with the cuticle (not volvate).. *Lepiota*

- † Hymenophore confluent.

- ‡ Without cartilaginous bark.

- § Stem central.

- || With a ring.....*Armillaria*

- || Ringless.

- Gills sinuate.....*Tricholoma*

- Gills decurrent.

- Edge acute.....*Clitocybe*

- Edge swollen, obtuse.....CANTHARELLUS

- Gills adnate.

- Parasitic on other Agarics..... NYCTALIS

- Not parasitic.

- Milky.....LACTARIUS

- Not milky.

- Rigid and brittle.....RUSSULA

- Waxy.....HYGROPHORUS

- § Stem lateral or absent.....*Pleurotus*

- ‡ With cartilaginous bark.

- Gills adnate.....*Collybia*

- Gills sinuate.....*Mycena*

- Gills decurrent.....*Omphalia*

- * Plant tough, coriaceous, or woody.

- † Stem central.

- Gills simple.....MARASMIUS

- Gills branched.....XEROTUS

- † Stem lateral or wanting.

- Gills toothed..... LENTINUS

- Gills not toothed.....PANUS

- Gills channelled longitudinally or crisped.....TROGIA

- Gills splitting longitudinally.....SCHIZOPHYLLUM

- Gills anastomosing.....LENZITES

II. Spores rosy or salmon color.—Hyporhodii.

- * Without cartilaginous bark.

- † Hymenophore free.

- ‡ With a volva.....*Volvaria*

- ‡ Without a volva.

- With a ring.....*Annularia*

- Ringless.....*Pluteus*

- † Hymenophore confluent, not free.

- ‡ Stem central.

- Gills adnate or sinuate.....*Entoloma*

- Gills decurrent.....*Clitopilus*

- ‡ Stem lateral or absent.....*Claudopius*

- * With cartilaginous bark.

- Gills decurrent.....*Eccilia*

- Gills not decurrent.

- In the Friesian classification which, with modifications, has prevailed for many years among mycologists, the *genus Agaricus* included in its *subgenera* the greater part of the species of the order *Agaricini*. The

In the Friesian classification which, with modifications, has prevailed for many years among mycologists, the *genus Agaricus* included in its *subgenera* the greater part of the species of the order *Agaricini*. The

subgenera, printed in the above table in italics, were included in this genus. The genera are printed in capitals. In the Saccardian system, all the *subgenera* of *Agaricus* having been elevated to *generic* rank, the term *Agaricus* is limited to a very small group which includes the *subgenus* *Psalliota* of Fries, the species being characterized by fleshy caps, free gills, ringed stem, and dark brown or purplish brown spores. As restricted, it naturally falls into the spore series *Melanosporeæ*.

In the white-spored section, *Leucospori*, the recorded edible species occur in the following genera: *Marasmius*, *Cantharellus*, *Lactarius*, *Russula*, *Hygrophorus*, *Collybia*, *Pleurotus*, *Clitocybe*, *Tricholoma*, *Armillaria*, *Lepiota*, and *Amanita*. The plants of *Marasmius* are usually thin and dry, reviving with moisture. *Cantharellus* is characterized by the obtuseness of the edges of the lamellæ, *Lactarius* by the copious milky or sticky fluid which exudes from the plants when cut or bruised. *Russula* is closely allied to *Lactarius*, and the plants bear some resemblance in external appearance to those of that genus, but they are never milky, and the gills are usually rigid and brittle. In *Hygrophorus* the plants are moist, not very large, often bright colored, and the gills have a waxy appearance. The *Collybias* are usually *cæspitose*, the stems exteriorly cartilaginous, in some species swelling and splitting open in the centre.

In *Pleurotus* the stem is lateral or absent. The plants are epiphytal, usually springing from the decaying bark of trees and old stumps.

In *Clitocybe* the plants are characterized by a deeply depressed, often narrow cap, with the gills acutely adnate, or running far down the stem, which is elastic, with a fibrous outer coat covered with minute fibres. Many of the species have a fragrant odor. The *Tricholomas* are stout and fleshy, somewhat resembling the *Russulas*, but distinguished from them by the sinuate character of the gills, which show a slight notched or toothed depression just before reaching the stem (represented in Fig. 4, Plate IV). Typical species of *Armillaria* show a well-defined ring and scales upon the stem, the remains of the partial veil, and the plants are usually large, and *cæspitose*. The *Lepiotas* are recognized by the soft, thready character of the fleshy portion of the cap, and the fringed scales formed by the breaking of the cuticle. The ease with which the ringed stem is removed from its socket in the cap is another characteristic which distinguishes the plants from those of other genera.

The *Amanitas* are distinguished by the *volva*, which sheathes the somewhat bulbous stem at its base and the ring and veil which in the young plant are very distinct features, the whole plant in embryo being enveloped in the *volva*.

The *Amanita* group, besides containing some very good edible species, is also credited with containing the most dangerous species of all the mushroom family, and some which are undoubtedly fatal in their effects.*

*A more detailed description of this group will appear in No. 5 of this series.

The *Nyctali* are minute mushrooms parasitic on other mushrooms.

In *Omphalia*, the plants are quite small, with membranaceous caps, gills truly decurrent, and cartilaginous stems.

The *Mycenæ* are generally very small, slender, and fragile, usually cæspitose, with bell-shaped caps, sinuate gills, not decurrent, and cartilaginous stems. In some species the plants exude a milky juice.

In the genera *Panus*, *Lentinus*, *Lenzites*, *Schizophyllum*, *Xerotus*, and *Trogia*, the plants are leathery or coriaceous, dry and tough, and though none are recorded as poisonous, they are too tough to be edible.

The mushrooms having pink or salmon colored spores, section *Rhodosporii*, form the smallest of the four primary groups of *Agaricini*, the number of known species not exceeding 400, and most of these are tasteless, or of disagreeable odor, while some are recorded as unwholesome.

The species are pink-gilled when mature, though often white or whitish when very young.

The recorded edible species are found in *Volvaria*, *Clitopilus*, and *Pluteus*. The *Volvariæ* are characterized by the very large and perfect volva which wraps the base of the stem in loose folds, the ringless stem, and the pink, soft, liquescent gills, which are free and rounded behind. The cap is not warted: in some species it is viscid, and in *bombycinus*, recorded by several authors as edible, and by some as doubtful, it is covered with a silky down.

In *Clitopilus* the odor of the edible species is more or less mealy. The cap is fleshy, and the margin at first involute. Two edible species which closely resemble each other—viz., *Clitopilus prunulus*, "Plum mushroom," and *Clitopilus orcella*, "Sweetbread mushroom."—are highly recommended for their delicacy of flavor.

In *Leptonia* most of the species are small, thin, and brittle, corresponding with *Mycena* in the white-spored series, and with *Psathyra* and *Psathyrella* in the dark-spored series.

Eccilia corresponds with *Omphalia*. *Claudopus* corresponds with *Pleurotus* in its habit of growth and lateral stem, differing in the color of the spores.

Annularia includes only a few small species having a ringed stem, no volva, and free pink gills. Cooke says of this subgenus that no British species are known.

The recorded species of *Pluteus* have their habitat on tree stumps, sawdust, or upon fallen timber. One species, *Pluteus cervinus*, is recorded as edible, but not specially commended. Of *Entoloma*, *Worthington* Smith says, "It is allied to *Tricholoma*, though most of the species are thinner and often brittle. It agrees also in structure with *Hebeloma* and *Hypholoma*." None of the species are recorded as having value as esculents.

The genus *Bolbitinus* is described by Cooke as a small genus intermediate between *Agaricus* and *Coprinus* on the one side, and *Coprinus* and *Cortinarius* on the other. The species are small and ephemeral.

Saccardo places *Bolbitius* in his division *Melanosporæ*, although the spores are ochraceous.

In the section *Pratelli* *Psalliota* and *Hypholoma* contain mushrooms which are of exceptionally fine flavor. In the first of these is found the common field mushroom *Agaricus campester* and its allies.

The black-spored section *Coprinarii* contains two genera which include a few recorded edible species, viz., *Coprinus* and *Gomphidius*. The *Psathyrellas* correspond in size to the *Mycenas* in the white-spored series and to the *Psathyras* in the purple-spored section: the gills are free or adnate and turn black when mature. None of the species are edible.

In *Paneolus* the plants are somewhat viscid when moist, the gills are described as "clouded, never becoming purple or brown." They are usually found on manure heaps near cities. None are edible.

Saccardo in his *Sylloge* combines the *Pratellæ* and *Coprinarii*, making of them one section which he calls *Melanosporæ*.

G. Massée, the British mycologist, makes of the black-spored and the purple and purplish-brown spored series two divisions, calling them, respectively, *Porphyrosporeæ* and *Melanosporæ*.

The recorded edible species of the spore section *Dermini* are found in *Pholiota*, *Cortinarius*, and *Paxillus*. The larger proportion of the *Phliotas* grow upon tree stumps. They have a fugacious, persistent friable ring, and are liable to be confused with the *Cortinarii*, unless attention is paid to the spidery veil and the iron-rust tint of the spores of the latter. Only a few of the species are recorded as edible, but none are known to be poisonous. *Cortinarius* is a large genus. It contains a larger proportion of edible species than *Pholiota*, and none are recorded as poisonous. The cobweb-like veil which extends from stem to margin of cap in the young species, and the rust-colored spores which dust the gills as the species mature, distinguish the genus from all others.

A characteristic feature of *Paxillus*, and one which makes it easily distinguishable from others of the same group, is the ease with which the gills as a whole can be separated from the substance or fleshy portion of the cap. There is an exception to this in the species *Paxillus involutus*, recorded by Peck as edible.

POLYPOREI.

Hymenium lining the cavity of tubes or pores which are sometimes broken up into teeth or concentric plates.—Berkeley's Outlines.

The plants of this second primary group or order of the family *Hymenomycetes* exhibit a greater dissimilarity of form and texture than do those of the *Agaricini*. Some of its genera consist almost wholly of coriaceous or woody plants. A few contain fleshy ones. Some of the species have a distinct stem, while others are stemless. With regard to the receptacle in the plants of the genera *Boletus*, *Strobilomyces*, etc., it forms a perfect cap, like that of the common *Agaric*, a cushion of tubes taking

the place of gills on the under surface of the cap, the hymenium in this case lining the inner surface of the tubes from which the spores drop when mature.

In some species, such as those of the genus *Poria*, the receptacle is reduced to a single thin fibrous stratum, adhering closely to the matrix and exposing a surface of crowded pores, and in others it consists of fibrous strata formed in concentric layers.

A number of groups, each of which was treated in the original Friesian classification as a single genus, have more recently been recognized as comprising several distinct genera. In the Saccardian system the genera *Trametes*, *Dædalea*, *Merulius*, *Porothelium*, and *Fistulina* still retain the generic rank assigned to them by Fries, but the old genus *Boletus* is subdivided into four genera, *Boletus*, *Strobilomyces*, *Boletinus*, and *Gyrodon*, while *Polyporus*, originally a very large genus, is subdivided into the genera *Polyporus*, *Fomes*, *Polystictus*, and *Poria*. This arrangement was in part suggested by Fries in his later works, and is accepted by M. C. Cooke, as indicated in his latest work on fungi.

Quoting M. C. Cooke, "*Strobilomyces* is *Boletus* with a rough warty and scaly pileus; *Boletinus* is *Boletus* with short, large radiating pores; and *Gyrodon* is *Boletus* with elongated sinuate irregular pores, all fleshy, firm fungi of robust habit, possessing stem and cap." The species of the genus *Polyporus* as now restricted are somewhat fleshy in the young stage, shrinking as they mature and dry, and becoming indurated with age. In *Fomes* the species, of woody consistency from the first, have no room for shrinkage, and are quite rigid; the tubes being in strata, and the strata growing yearly, the species are virtually perennial. The pileus of the plant shows a rigid polished crust resulting from resinous exudations.

In *Polystictus* the plants are usually small, thin, tough, and irregular in outline, the tubes exceedingly short, with thin walls, which easily split up, giving the pores at times a toothed or fringed appearance. The surface is velvety, or hairy, and zoned in varying colors. They are very common upon decaying tree stumps, often covering the surface of the stump in gaily colored layers. Not esculent.

Poria is composed of resupinate species with the pores normally in a single series, the whole stratum spread over, and adhering to the matrix. The species are coriaceous or woody. Not esculent.

The plants of the genus *Trametes* allied to *Fomes* are epiphytal, with the trama the same in substance and color as the hymenophore. The tubes do not form in regular strata, but are sunk into the substance of the pileus. The plants are coriaceous, and none are edible.

Dædalea closely resembles *Trametes* with the tubes forming deep labyrinthiform depressions. Whole plant woody, sessile.

Hexagonia, allied by its characteristics to *Polystictus*, has large hexagonal pores, with firm, entire dissepiments.

In *Favolus* the plants are slightly fleshy and substipitate with the pores angular, and radiating from the stem. Not edible.

The species of the genus *Laschia* are recognized by the shallow irregular pores and the vein-like character of their dissepiments (or pore walls). Substance slightly gelatinous.

In the plants of *Porothelium*, irregular papillæ take the place of tubes, and the plants are sub-membranaceous and resupinate, having the habit of those of *Poria*.

The genus *Merulius* has been termed the lowest and most imperfect of the genera of Polyporei. It presents a soft, waxy spore-bearing surface, reticulated with obtuse folds. *Solenia*, by early authors placed in *Discomycetes*, thence transferred to *Auricularini*, and by some authors associated with *Cyphella* in *Theleporei*, now finds place as one of the genera of Polyporei as given by Saccardo.

The above-mentioned genera, together with *Myriadoporus*, *Ceriumyces*, *Bresadolia*, *Theleporus*, *Gleporus*, and *Cyclomyces*, constitute the Polyporeæ of the Saccardian system.

Myriadoporus is a North American genus. It is a form of the genus *Polyporus*, but with pores in the *interior* as well as on the *exterior* surface. *Ceriumyces* is generally regarded as a spurious genus. It is similar to *Myriadoporus*, but with internal pores and only spurious pores externally. Of *Bresadolia* Cooke says "there is only one described species, and of this only one specimen has been found." *Theleporus* is an African genus of which only one species is known. *Gleporus* is a form of resupinate *Polyporus*, except that the hymenium or pore-bearing surface is gelatinous instead of being firm. *Cyclomyces* is a genus with some features of *Lenzites*; it is leathery. All of these are more or less coriaceous. None are edible. *Campbellia* is a new genus. It is *Merulius* with a pileus and central stem.

The edible Polyporeæ are found in the genera *Boletus*, *Strobilomyces*, *Gyrodon*, *Boletinus*, *Polyporus*, and *Fistulina*. Of these, the first four genera contain most of the edible species as well as a few which have been regarded as unwholesome or poisonous.

In the genus *Polyporus* as now restricted, the species *Polyporus sulphureus* Fries is perhaps the one most likely to be selected for table use, the others becoming very quickly indurated or tough, and this should be gathered when very young, as in maturity it loses its fleshy consistency and becomes dry and tough. It is common on old tree stumps and is often found on the dead wood of living trees, the bright yellow and vivid orange red tints which characterize the young plant making it very conspicuous.

It is easily recognized by its irregular, closely overlapping frond-like caps, white flesh, and the very small sulphur-yellow tubes. The spores are white, elliptical. The flesh of young specimens is somewhat juicy.

The geographical distribution is wide, and in places where a moist, warm temperature prevails plants of this species often attain very large proportions, sometimes completely encircling the trunk of a tree at its base. The bright colors fade as the plant matures, and the plant be-



FISTULINA HEPATICA.

- 1 Specimen, upper view. 2 Same, under view.
3 Specimen, upper view. 4 Same, under view.
5 Spores.

comes indurated and friable, when very old crumbling readily in the hands.

To prepare for the table, very thin slices of young specimens should be cut and either allowed to slowly simmer on the back of the range, or soaked in milk and then fried in butter.

Of the genus *Fistulina* but one species, *Fistulina hepatica*, figured in Plate X, is recorded as edible and indigenous to this country.

PLATE X.

Fistulina hepatica Bull. "*Beefsteak Mushroom*," "*Liver Fungus*."

EDIBLE.

Genus Fistulina Bull. Hymenophore fleshy, hymenium inferior, that is, on the under surface of the cap, at first papillose; the papillæ at length elongated, and forming distinct tubes.

Besides *Fistulina hepatica*, five species of this genus are recorded in Saccardo's *Sylloge*, viz., *F. radicata* Schw., *F. spathulata* B. & C., *F. palida* B. & R., *F. rosea* Mont., and *F. antarctica* Speg.; the last indigenous to Patagonia.

F. hepatica is the only species with which I am familiar. The plants of this species are very irregular in form, rootless, epyphytal, often stemless, and sometimes attached to the matrix by a very short stem. This fungus is frequently found upon old oak, chestnut, and ash trees, developing in the rotting bark. It appears first as a rosy pimple, or in a series of red granules. In a very short time it becomes tongue-shaped, sometimes kidney-shaped, assuming the color of a beet root. As it increases in size it changes form again, becoming broad in proportion to its length, and changing in color to a deep blood-red, and finally to a dull liver tint. Its lower surface is often paler than its upper, it being tinged with yellow and pinkish hues.

One author states that it requires about two weeks to attain its highest development, after which it gradually decays.

It varies in size from a few inches to several feet in circumference. Rev. M. J. Berkeley mentions one which weighed thirty pounds. It has been styled the "*poor man's fungus*," and in flavor resembles meat more than any other.

The substance is fleshy and juicy in the early stage. The pileus is papillose, the papillæ elongated, and forming distinct tubes as the pileus expands. These tubes are separable from each other, and with age become approximate and jagged at their orifices. The tubes are at first yellowish, with a pink tinge, becoming dingy with age. The fleshy substance, or hymenophore, is often veined in light and dark red streaks. The juice is pellucid, red, and slightly acid. Spores at first nearly round, becoming elliptical, salmon color.

This fungus is esteemed in Europe, where it is eaten prepared in a variety of ways.

When young and tender it can be sliced and broiled or minced and stewed, making a delicious dish. When too old the stock is rather tough for good eating, but the gravy taken from it forms a rich flavoring for a vegetable stew or a meat ragout. The following recipe for cooking this mushroom has been recommended:

Slice and macerate it, add pepper and salt, a little lemon, and chopped onions or garlic: then strain and boil the liquid, which makes most excellent gravy, resembling that of good beefsteak.

The *Fistulina hepatica* is well known in Europe, and is found in different parts of the United States, in some places growing abundantly. I have gathered some fine specimens in Maryland and Virginia, but none as large as that described by Dr. Berkeley.

RECIPES FOR COOKING MUSHROOMS.

To Pot Mushrooms.—The small open mushrooms suit best for potting. Trim and rub them; put into a stewpan a quart of mushrooms, 3 ounces of butter, 2 teaspoonfuls of salt, and half a teaspoonful of cayenne and mace, mixed, and stew for ten or fifteen minutes, or till the mushrooms are tender; take them carefully out and drain them perfectly on a sloping dish, and when cold press them into small pots and pour clarified butter over them, in which state they will keep for a week or two. Writing-paper placed over the butter, and over that melted suet, will effectually preserve them for weeks in a dry, cool place.

To Pickle Mushrooms.—Select a number of sound, small pasture mushrooms, as nearly alike as possible in size. Throw them for a few minutes into cold water, then drain them, cut off the stalks, and gently rub off the outer skin with a moist flannel dipped in salt; then boil the vinegar, adding to each quart two ounces of salt, half a nutmeg grated, a dram of mace, and an ounce of white pepper corns. Put the mushrooms into the vinegar for ten minutes over the fire; then pour the whole into small jars, taking care that the spices are equally divided; let them stand a day, then cover them.

Baked Mushrooms.—Peel the tops of twenty mushrooms; cut off a portion of the stalks and wipe them carefully with a piece of flannel dipped in salt. Lay the mushrooms in a tin dish, put a small piece of butter on the top of each, and season with pepper and salt. Set the dish in the oven and bake them from twenty minutes to half an hour. When done, arrange them high in the centre of a very hot dish, pour the sauce around them, and serve quickly and as hot as you possibly can.

Mushrooms with Bacon.—Take some full-grown mushrooms, and, having cleaned them, procure a few rashers of nice streaky bacon and fry them in the usual manner. When nearly done add a dozen or so of mush-

rooms and fry them slowly until they are cooked. In this process they will absorb all the fat of the bacon, and with the addition of a little salt and pepper will form a most appetizing breakfast relish.

Mushroom Pie.—A very good mushroom pie is made in the following manner: Chop a quart of mushrooms into small pieces, season to taste, and add one pound of round steak chopped fine and seasoned with a small piece of onion. If the steak is lean, add a small piece of suet, unless butter is preferred to give flavor. Put the chopped steak and mushrooms in deep saucepan with cover, and stew slowly until tender. Make a crust as for beefsteak pie and put in a deep earthen dish, lightly browning the under crust before adding the stew, and cover with a crust lightly punctured.

In some parts of Russia mushrooms form an important part of the diet of the people, especially during the Lenten season, when the fast of the Greek church is very strictly kept, and meat, fish, eggs, and butter are forbidden.

Provision is made for this season in the securing of quantities of dried and salted mushrooms, which are cut up in strips and made into salads with a dressing of olive oil and vinegar. The poorer classes to whom the olive oil is unattainable use the rape seed and other vegetable oils in the cooking of their mushrooms.

The following recipes are translated from a recently published Russian work on the subject of mushrooms, cultivated and wild:

Select fresh, sound Boleti, cut off the caps, and, after wiping clean with a napkin, place them in a sieve, pouring over them scalding water; when thoroughly drained, leave them where there is a free current of air until perfectly dry. Next string them upon stout twine, leaving spaces between to allow of free circulation of air. If convenient, they can be dried artificially by placing in a not too hot oven with the door open. Dried by either method, they can be kept all winter. Before using, they should be soaked in water or milk until soft. In this condition they make very good flavoring for soup or gravy, and can also be used as filling for pies.

Mushrooms Cooked in Butter.—Wipe the mushrooms clean and dip in dry flour. Heat a quantity of butter to boiling temperature in a saucepan, seasoning with a small piece of onion. Drop the flour-covered mushrooms into the boiling butter, shaking the pan constantly over the fire. When the mushrooms are cooked add sour cream to taste. Before serving, sprinkle with grated muscat nut.

Mushroom Pickle.—Select only young button mushrooms. Put them for a few moments in boiling water lightly salted and vinegared. Boil vinegar (only the best should be used), spicing it according to taste. Allow the vinegar to cool. Put the mushrooms in layers in a jar and pour over them enough spiced vinegar to cover. Seal tightly.

Salted Piperites.—Only the caps are taken of the *Lactarius piperites*. They are placed first in salted scalding water for several minutes. The water is then gently pressed out with a napkin, the mushrooms are

placed on sieves and cold water poured over them. They are then placed in layers in a jar, each layer sprinkled with salt, and whole pepper and minced onion scattered over the layer. When the jar is full a thin round board is placed upon the top layer and pressed down with weights, and as the mass gives way mushrooms are added until the jar is compactly filled. The jar is then covered with parchment or otherwise tightly sealed. Eight gallons of mushrooms require from one to one and a half glasses of salt. This makes a good salad when treated with oil.

NOTE.—*L. piperites* is an extremely acrid mushroom when in the raw state, and the Russians do not stew it, but prepare it in the above way, taking the precaution to scald thoroughly with salted water before putting away. The precaution of scalding through several waters is a wise one to use in the preparation of all mushrooms inasmuch as the poisonous principle of most mushrooms is soluble in scalding water. Dilute vinegar is frequently used in the same manner. Vinegar should not be used in metal vessels unless porcelain-lined.

LIST OF THE GENERA OF HYMENOMYCETES.

The following list of the genera of Hymenomycetes, summarized from Kellerman's Synopsis of Saccardo's Sylloge Fungorum, will be found useful for reference :

I.—AGARICACEÆ.

Leucosporæ. (Spores white or slightly tinted yellowish.)

GENERA.

Amanita Pers.
Amanitopsis Roze.
Lepiota Fries.
Schulzeria Bres.
Armillaria Fries.
Tricholoma Fries.
Clitocybe Fries.
Collybia Fries.
Mycena Fries.
Hiatula Fries.
Omphalia Fries.
Pleurotus Fries.
Hygrophorus Fries.
Lactarius Fries.
Russula Pers.
Cantharellus Adans.
Arrhenia, Fries.
Nyctalis Fries.
Stylobates Fries.
Marasmius Fries.
Heliomyces Lev.
Lentinus Fries.
Panus Fries.
Xerotus Fries.
Trogia Fries.
Leuzites Fries.
Tilotus Kalch.
Hymenogramme B. & Mont.

Oudemansiella Speg.
Pterophyllus Lev.
Rachophyllus Berk.
Schizophyllum Fries.

Rhodospore (spores pink or salmon color), corresponding to the *Hyporhodii* of Fries.

GENERA.

Volvaria Fr.
Annularia Schulz.
Pluteus Fries.
Entoloma Fries.
Clitopilus Fries.
Leptonia Fries.
Nolanea Fries.
Eccilia Fries.
Claudopus Worth. Smith.

Ochrospore (spores tawny ochraceous, or light rusty tint of brown), corresponding to the *Dermiini* of Fries.

GENERA.

Pholiota Fries.
Locellina Gill.
Inocybe Fries.
Hebeloma Fries.
Flammula Fries.
Naucoria Fries.
Pluteolus Fries.
Galera Fries.
Tubaria Worth. Smith.
Crepidotus Fries.

Cortinarinus Fries.
Paxillus Fries.

Melanospora (spores black, dark-brown or purplish-brown), combining the attributes of both the *Coprinarii* and the *Pratelli* of Fries.

GENERA.

Chitonina Fries.
Agaricus Linn.
Pilosace Fries.
Stropharia Fries.
Hypholoma Fries.
Psilocybe Fries.
Deconica Worth. Smith.
Psathyra Fries.
Bolbitinus Fries.
Coprinus Pers.
Panæolus Fries.
Annellaria Karsh.
Psathyrella Fries.
Gomphidius Fries.
Anthracophyllum Ces.
Montagnites Fries.

II.—POLYPORACEÆ (Polyporei).

GENERA.

Boletus Dill.
Strobilomyces Berkeley.
Boletinus Kalchbr.
Gyrodon Opatowski.
Fistulina Bull.
Polyporus Mich.
Fomes Fries.
Polystictus Fries.
Poria Pers.
Trametes Fries.
Hexagonia Fries.
Dædalea Pers.
Myriadoporus Peck.
Ceriumyces Corda.
Bresadolina Speg.
Cyclomyces Kunz.
Favolus Fries.
Glæoporus Mont.
Laschia Fries.
Merulius Hall.
Theleporns Fries.
Porothelium Fries.
Solenia Hoffm.

III.—HYDNACEÆ (Hydnei).

GENERA.

Hydnum Linn.
Caldesiella Lacc.
Hericium Pers.
Tremellodon Pers.
Sistotrema Pers.
Irpex Fries.
Radulum Fries.
Plebia Fries.
Lopharia K. & M. Ow.
Grandinia Fries.

Grammothele B. & C.
Odontia Pers.
Kneiffia Fries.
Mucronella Fries.

IV.—THELEPHORACEÆ (Thelephorei).

GENERA.

Craterellus Fries.
Hypolyssus Pers.
Thelephora Ehrh.
Cladoderris Pers.
Beccariella Ces.
Stereum Pers.
Hymenochaete Lev.
Skepperia Berk.
Corticium Fries.
Peniophora Cooke.
Coniophora D. C.
Michenera B. & C.
Matula Mass.
Hypochnus Fries.
Exobasidium Weron.
Helicobasidium Pat.
Cyphella Fries.
Friesula Speg.
Cora Fries.
Rhipidonema Matt.

V.—CLAVARIACEÆ (Clavariei).

GENERA.

Sparassis Fries.
Acartis Fries.
Clavaria Vaill.
Calocera Fries.
Lachnocladium Lev.
Pterula Fries.
Ptifula Pers.
Pistallaria Fries.
Physalacia Peck.

VI.—TREMELLACEÆ (Tremellini)

GENERA.

Auricularia Bull.
Hirneola Fries.
Platyglæa Schroet.
Exidia Fries.
Ulocolla Bref.
Craterocolla Bref.
Femsjonina Fries.
Tremella Dill.
Næmatelia Fries.
Gyrocephalus Pers.
Delortia Pat. & Gail.
Arrhytidia Berk.
Ceracea Cragin.
Gnepinia Fries.
Dacryomitra Pul.
Collyria Fries.

GENERA MINUS CERTA.

Hormonyces Bon.
Ditiola Fries.
Apyrenium Fries.

BREFIELD'S CLASSIFICATION OF FUNGI.

A system of classification of fungi which is receiving attention from mycologists is that recently presented by the distinguished German author Dr. Oscar Brefield. Dr. Brefield's exhaustive investigations into the life-history of fungi in general have been such as to entitle his views to consideration, although the system presents some inconsistencies which may prevent its adoption in its entirety.

According to the Brefield system, as summarized by his colleague Dr. Von Tavel, Fungi are divided into two primary classes: (1) the *Phycomycetes*, or lower fungi nearest like the algæ, *consisting of a one-celled thallus with sexual as well as non-sexual modes of reproduction*, and (2) the *Mesomycetes* and the *Mycomycetes*, *having a divided or many celled thallus, propagated by non-sexually formed spores*. The *Phycomycetes* are further divided into two large sections, based on their methods of reproduction, termed, respectively, *Zygomycetes* and *Oomycetes*. These include the old typical *Mucors*, the *Peronosporæ* or "rotting moulds," once classed with the *Hyphomycetes*, the *Saprolegniaceæ*, "Fish Moulds," of aquatic habit, the *Entomophthoraceæ*, "Insect Moulds," together with some minor groups. The *Mesomycetes* connect the *Phycomycetes* with the *Mycomycetes*. The class *Mycomycetes* is primarily divided into two sections, viz., *Ascomycetes* and *Basidiomycetes*, with the *Ustilagineæ*, "Smut Fungi," in *Mesomycetes*, forming a transitional group between *Phycomycetes* and the *Basidiomycetal* group of the higher fungi.

The *Ascomycetes* are primarily subdivided into *Exoasci* and *Carpoasci*, groups based on the character of the asci. In the first, *Exoasci*, the asci are naked and borne directly on the mycelium; in the second, *Carpoasci*, they are enclosed in a wrapper composed of fertile hyphæ and sterile threads, having also accessory fruit forms. The first includes *Endomycetes* and *Taphrinææ*. In the second are included the groups *Gymnoasci*, *Perisporaceæ*, *Pyrenomycetes*, *Hysteriaceæ*, *Discomycetes*, and *Helveliaceæ*.

The *Basidiomycetes* characterized by the possession of basidia are arranged in two groups, based on the character of the basidia: (1) the *Protobasidiomycetes*, in which the basidia are septate, divided, and (2) the *Autobasidiomycetes*, in which the basidia are not divided, and bear a definite number of spores.

The first of these (*Protobasidiomycetes*) includes the following distinct groups: (1) the *Uredinææ*, "Rust Fungi," which have horizontally divided basidia, always free, never enclosed; (2) the *Auriculariææ*, having basidia somewhat resembling those of the *Uredinææ*, but which are borne in fruit bodies with open hymenia; (3) *Pileacææ*, having horizontal septate basidia in closed receptacles; and (4) *Tremellinææ*, having vertically divided basidia borne in gymnocarpous receptacles—that is, those in which the hymenium is exposed while the spores are growing.

The *Autobasidiomycetes* are characterized by undivided basidia, bear-

ing spores only at the apex. This group is subdivided into three sections: (1) Dactyromycetes, which includes the lowest of the Tremelloid forms, with club-shaped basidia, nearly approaching the true Hymenomycetetal type, together with several groups of minor import: (2) Gasteromycetes; and (3) Hymenomycetes, with Phalloideæ placed in the group as a subsection of Gasteromycetes.

The above can only be considered as a very brief abstract of the system of classification proposed by Dr. Brefeld, but it will serve to give some idea of the principle on which the system is based, which is sufficient for our present purpose. Those who wish to study the system in detail will find it treated in a comprehensive manner in Dr. Von Tavel's summary as it appears in the *Vergleichende Morphologie der Pilze*, Jena, 1892.

CONIOMYCETES AND HYPHOMYCETES.

In the original classification of Fries two of the primary divisions of the sporiferous Fungi were termed, respectively, *Coniomyces* and *Hyphomyces*. This arrangement was accepted by Berkeley, the term *Coniomyces* being applied to all fungi in which the naked spores, appearing like an impalpable dust, were the principal feature of the plant, and the term *Hyphomyces* to fungi in which the threads or hyphæ bearing the spores were the most conspicuous feature.

Coniomyces, as broadly interpreted by Berkeley and other mycologists of his day, included the Uredineæ or "rust fungi," the Ustilagineæ or "smut fungi," the Sphærospideæ, and the Melanconieæ. This arrangement was very unsatisfactory on account of the distinctively different character of the methods of reproduction of the respective groups, and they have since been disassociated and by some authors ranked as distinct orders or families. Others combine Uredinei and Ustilaginei in one group under the name Hypodermi.

Familiar examples of Uredinei are seen in the rust of the Barberry leaf, etc., and of the Ustilaginei in the "smut" of corn and the "bunt" of wheat.

Some authors combine the Sphærospideæ with the closely allied Melanconieæ. M. C. Cooke contends that the *Sphærospideæ* should be considered apart from the *Melanconieæ*, on the fundamental basis that the former possess a distinct perithecium, while the latter do not.

The *Sphærospideæ* as recently defined by Cooke are "Fungi possessed of a perithecium, but without asci, the sporules or stylospores being produced internally at the apex of more or less distinct supporting hyphæ or pedicels, termed sporophores."

The Sphærospideæ somewhat resemble the Pyrenomycetæ in external characteristics, but differ from them in the absence of asci and paraphyses. Saccardo retains all the species in his Sylloge, but relegates them to an inferior position as imperfect fungi.

The group *Pyrenomycetes*, or *Sphæriacei*, as at first recognized by Fries, included not only the *Sphæriacei* and the *Perisporacei*, but also

the *Sphaeropsidei* and *Melanconiaceæ*. Later, when ascigerous fungi were separated from stylosporous fungi, this group was revised, the ascigerous species only being retained. As at present limited, the Pyrenomycetes are "*ascigerous* fungi having the fructification enclosed within a perithecium."

They constitute a very large group, the described species, according to Cooke's Census of Fungi, numbering not less than 10,500, or at least 1,000 more than all the recorded species of Hymenomycetes. The plants are microscopic in size, and grow upon vegetable or animal substances.

HYPHOMYCETES.

With regard to the Hyphomycetes, Cooke takes the ground that in their internal relations to each other, and their external relations to the remaining orders, the Hyphomycetes are undoubtedly a well-defined and natural group, and should have place as such in a systematic work. It is a large order, containing nearly 5,000 species, mostly parasitic on dead animals and vegetable matter. The spores, termed conidia, are free, as in Hymenomycetes. The species are microscopic in size, and the hyphæ are strongly developed. They have no hymenium and no true basidia, and are non-sexual in their reproduction.

The four primary sections are the Mucedineæ, or "white moulds;" the Dematiæ, or "black moulds;" the Stilbeæ, with the hyphæ or thread-like filaments pallid or brown, and densely cohering, and the Tuberculariæ, with the hyphæ densely compacted in wart-like pustules of somewhat gelatinous consistency.

The divisions called Melanconiæ, Sphaeropsidæ, and Hyphomycetæ are not recognized in the Brefeld system of classification as distinct groups. Massée and Cooke, with other mycologists, take exception to this omission and its implication, in their discussion of the subject, giving consistent reasons for the retention of these groups in systematic works.

PHYCOMYCETES OR PHYSOMYCETES.

As originally defined by Berkeley, this group was composed chiefly of the old typical Mucors and their allies, and was then termed Physomycetes. In the newer system of classification its original definition has been extended so as to include a number of groups somewhat dissimilar in their habits and characteristics, but "united under the conserving bond of a dimorphic reproduction," and the name has been changed to Phycomycetes. As at present recognized "the Phycomycetes are characterized by a unicellular mycelium, often parasitic on plants or animals, sometimes saprophytic, developed in the air or in water. Reproduction sexual or asexual." As thus interpreted, Phycomycetes includes the Mucoracei; the Peronosporaceæ, or "rotting moulds"; the Cystopi, or "white rusts"; the Saprolegniaceæ, or "fish moulds"; the Entomothoraceæ, or "insect moulds," together with a few minor groups of doubtful natural affinity.

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APPENDIX.

Superior, the upper surface; applied to the ring when near the apex of the stem.

Tetraspore, *tetra* Gr. four; spois.

Theca, cell-mother, the protoplasm of which originates by segmentation: a certain number of spores, usually eight, held in suspension in the protoplasm of the theca without being attached to each other or to the cell walls.

Thecaspore, the spore thus encased.

Tomentose, downy, with short hairs.

Torsive, spirally twisted.

Torulose, a cylindrical body swollen and restricted alternately.

Toxic, poisonous.

Trama, the substance proceeding from the hymenophore, intermediate between the plates (central in) of the gills of agarics.

Transverse, crosswise.

Tremelloid, jelly-like.

Truncate, ending abruptly, as if cut short; cut squarely off.

Tubaform, trumpet-shaped.

Tubercle, a small wart-like excrescence.

Tubular, hollow and cylindrical.

Turbinate, top-shaped.

Typical, agreeing closely with the characters assigned to a group or species.

Umbilicate, having a central depression.

Umbo, the boss of a shield; applied to the central elevation of the cap of some mushrooms.

Umbonate, having a central boss-like elevation.

Uncinate, hooked.

Unequal, short imperfect gills interspersed among the others.

Universal, used in relation to the veil or

volva which entirely envelops the mushroom when young.

Variety, an individual of a species differing from the rest in external form, size, color, and other secondary features, without perpetuating these differences only under exceptional circumstances.

Veil, in mushrooms a partial covering of the stem or margin of the pileus.

Veliform, a thin veil-like covering.

Venate, *Veined*, intersected by swollen wrinkles below and on the sides.

Ventricose, swollen in the middle.

Vernicose, shining as if varnished.

Verrucae, warts or glandular elevations.

Verrucose, covered with warts.

Villose, *villous*, covered with long, weak hairs.

Virescent, greenish.

Virgate, streaked.

Viscid, covered with a shiny liquid which adheres to the fingers when touched.

Viscous, gluey.

Volute, rolled up in any direction.

Volva, a substance covering the mushroom, sometimes membranous, sometimes gelatinous; the universal veil.

Walnut brown, a deep brown like that of some varieties of wood. (Raw umber, and burnt sienna and white.)

Wart, an excrescence found on the cap of some mushrooms; the remains of the volva in form of irregular or polygonal excrescences, more or less adherent, numerous, and persistent.

Zone, a broad band encircling a mushroom.

Zoned, furnished with one or more concentric circles.

Although some writers apply the terms spore, sporidia, sporophore, sporules, and conidia somewhat indiscriminately to all spore bodies, in order to avoid confusion, it is now recommended by the best authorities that certain distinctive limitations should be adhered to in the use of these terms. Saccardo, in defining the terms which he employs, accepts the term spores as applicable exclusively to the naked spores supported on basidia, as found in the Basidiomycetæ. The term sporidia he limits to spores produced or enclosed in an ascus, as in the Ascomycetæ. The term sporules he applies to the spores of imperfect fungi, where they are enclosed in perithecia (microscopic cups or cells), such as the Sphærospideæ. The term conidia he uses to designate the spores of imperfect fungi without perithecia or asci, such as the Hyphomycetæ and the Melanconieæ. This arrangement is in accordance with M. C. Cooke's published views on the subject, except in the case of the spore bodies of the Melanconieæ, which he prefers, for well-defined reasons, to call sporules.

In accordance with these limitations, the terms *spermatia*, *stylospores*, and *clino-spores* are merged in *sporule*.

Other terms appropriate to their development are employed to designate the spores of Uredineæ, Phycomycetæ, etc.

